

## **Basement uplift piles – COVA Commercial Development, Isle of Capri, Gold Coast**

**Project Engineer:** ADG

**Number of Piles:** 233

**Client:** Hutchinson Builders

**Pile Capacity:** Up to 375kN ULS

**Main Contractors:** Hutchinson Builders

**Project Date:** March 2013



### **Project Description and Challenges**

The COVA re-development on the Isle of Capri near Surfers Paradise is a modern commercial complex offering boutique shopping, gourmet food and beverages to local residents and tourists. The project has revitalised a once thriving retail hub that became run down and tired with age.

To maximise the land use and to comply with modern town planning requirements, basement parking was required beneath the entire site which provided challenges to the designers and builders due to the sandy soils and proximity to the Nerang River.

The depth of the basement was required to be below the water table which regularly rises and falls due to tidal influences from the adjacent river. During major flood events, the sandy soil can also become fully saturated which induces major uplift forces on the foundations as the waterproof basement begins to act like the hull of a ship when the basement is submerged.

In addition to the uplift forces from the buoyancy effects of the water table, the soft ground conditions required that the foundations handle the significant vertical forces from the weight of the structure. The challenge for the designer was to come up with a foundation solution that worked equally well in both tension and compression.

## **The Solution**

In November 2011, PCA was engaged to install and test two grout injected micropiles to determine their suitability for the project. The two test piles were installed from ground level prior to excavation of the basement. The upper 3m of the test piles were debonded with PVC sleeves to ensure they did not engage any skin friction in the zone that was to be excavated during construction.

The piles were tested in tension to the yield capacity of the reinforcement proving that the grout injected micropiles were up to the job. As a result, ADG Civil Engineers specified PCA's micropiles into the final design with construction commencing in March 2013.



Load testing micropiles prior to final design



Installing micropiles from lower basement level into upper basement level



Installing micropiles in lower basement

## **The Micropile Advantage**

The soil conditions below the basement excavation were fairly consistent across the site. On average, there was 2m of loose sand directly beneath the base of the excavation overlying a 4m thick layer of indurated sand which sat atop of 10m of a mixture of sands and clays with low bearing strength before reaching the underlying bedrock.

A conventional piled foundation would have required fully cased piles to be drilled down 16m to bedrock and then socketed into the underlying bedrock for several metres to ensure the high uplift forces could be developed. During excavation of the piles, the material being brought to the surface had the potential for acid sulphate conditions to occur which could have required additional treatment prior to disposal.

Grout injected micropiles develop high skin friction values with the surrounding soils for their entire length and can be targeted at layers within the soil column rather than being drilled all the way down to bedrock. As such, full advantage was taken of the 4m thick indurated sand layer positioned almost directly beneath the basement excavation with multiple moderate capacity micropiles drilled into the indurated strata to develop the load at each location. By not having to drill 16m down to bedrock, a significant saving in both time and construction costs could be made on the project.

Access to some of the pile locations was also limited due to tight site constraints. PCA's excavator mounted drill rigs were able to access the difficult pile locations through their extended reach from the lower basement level. This saved the client significant costs and time as they were able to leave their dewatering system in place while the micropiles were installed around the delicate pipework and equipment without the need to shut the system down or relocate it during construction.